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ABSTRACT

To study the applicability of the Kaufman Assessment Battery for Children (K-ABC) for assessing hearing-impaired children, nine hearing-impaired children (ranging in age from 6 years 4 months to 11 years 10 months) were administered the battery. Hearing losses for the nine children ranged from moderate to profound. During the evaluation of seven of the nine children tested, a sign language translator was present. Results were analyzed in terms of subtest reliability and item characteristics; the results were then compared with the norming data. All subtests comprising the mental processing composite were administered with the exception of number recall. The sample obtained its lowest mean score on sequential and simultanous processing. Hearing-impaired children tended to perform well on the attention component of the spatial memory subtest. Results support the reliability of the Non-verbal Scale of the K-ABC for hearing-impaired children. Analysis of subtest items offers support for the validity of Non-verbal Scale subtests for this population. Additionally, it was found that the Gestalt Closure subtest of the Simultaneous Scale provided reliable and valid information for this sample. It appears that the use of a sign language translator would improve the process of test administration for this population. Nine data tables are included. (TJH)

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A Study of the Performance of Hearing Impaired Children on the K-ABC

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The goal of psychological assessment is to provide a measure of a child's cognitive abilities. The development of effective educational programs for special populations is dependent in large part, on obtaining an accurate and reliable clinical picture of a child's funtional level within the context of evidenced cognitive strengths and weaknesses. Efforts to obtain valid, reliable and useful cognitive assessments of hearing impaired children has generally proven to be problematic. Most commonly accepted measures of cognitive functioning rely heavily on verbal components. Such measures are generally inappropriate for hearing impaired populations. Additionally, it has been suggested that the use of timed performance measures may be less appropriate for hearing impaired children than for non hearing impaired children (Sattler, 1988).

Three instruments commonly used to assess hearing impaired children are the Leiter International Performance Scale (LIPS) (Leiter, 1948), the Hiskey-Nebraska Test of Learning Aptitude (H-NTLA) (Hiskey, 1966), and the Performance Scale of the Wechsler Intelligence Scale for Children - Revised (WISC-R) (Wechsler, 1974). Both the LIPS and H-NTLA provide nonverbal measures of intelligence however the norm groups for both instruments are questionable and in both instances the norms may be considered outdated (Sattler, 1988).

The Performance Scale of the WISC-R is perhaps the most frequently used measure for assessing intelligence in hearing impaired children. While noting adequate reliability and concurrent validity, Hirshoren, Hurley and Kavale (1979) Suggested possible short comings of the Performance Scale as used with

hearing impaired populations. The authors noted that the instrument did not appear to be a clinically useful predictor of achievement for deaf children between the ages of 8 and 13. Additionally, it was noted that total communication methods of administration resulted in higher schores than did standard verbal directions and those using visual cues and pantomime.

The timed aspect of Performance Scale subtests might also be considered problematic in assessing hearing impaired children.

An alternative to the instruments noted above is the Kaufman Assessment Battery for Children (K-ABC) (Kaufman & Kaufman, 1983). The K-ABC assesses intelligence in terms of a child's preferred style of problem solving and of processing information (Kaufman & Kaufman, 1983). It provides a global Mental Processing Composite (MPC) comprised of Simultaneous (SIM) and Sequential (SEQ) scales. As a means of assessing abilities more closely attuned to achievement, a separate Achievement (ACH) Scale is provided. Of particular interest for assessment of hearing impaired children is the instrument's Nonverbal Scale. This schale is comprised of one SEQ subtest, Hand Movements, and four SIM subtests including Triangles, Matrix Analogies, Spatial Memory, and Photo Series, These subtests are designed so as to permit pantomimed administration and nonverbal responses. The pantomimed administration may include demonstrations, pointing, and/or facial gestures as communication prompts.

Beyond the Nonverbal Scale, the K-ABC may prove efficacious for evaluating some hearing impaired children as one of the professed goals of the authors was to minimize the language component of all MPC subtests (Kaufman & Kaufman, 1983). Directions for subtests are generally direct and uncomplicated and responses require limited verbal production.

To date, limited research is available concerning the

application of the K-ABC to hearing impaired children. As reported by Kaufman and Kaufman (1983), Courtney, Hayes, Watkins and Frick (validity study 11) tested 40 hearing impaired children using the nonverbal Scale of the K-ABC. Additionally, sign language was used to administer the Gestalt Closure subtest of the SIM Scale. The authors reported that results evidenced strong performance on subtests requiring simultaneous processing. Greatest difficulties were noted on subtest requiring integration of sequential and simultaneous processing. Highest mean scores were noted on Gestalt Closure and Triangles while relatively poor performances were evidenced on Matrix Analogies, Photo Series and Hand Movements.

Kamphaus and Reynolds (1987) reported studies by Ham (1985) and Ulissi, Brice and Gibbons (1985). Both studies indicated that hearing impaired children, including residential populations, scored within the average range when administered the Nonverbal Scale of the K-ABC in pantomime fashion. Similar results were noted by Porter and Kirby (1986). Additionally, Porter and Kirby examined the relative effects of administration of the Nonverbal Scale using pantomime and gestures as opposed to employing American Sign Language. No significant differences were noted between methods.

Kennedy and Hiltonsmith (1988) compared the performance of speech and language disabled preschool children on the K-ABC, the Pictorial Test of Intelligence (PTI) (French, 1964), and the H-NTLA (Hiskey, 1966). While somewhat lower mean scores were evidenced on the K-ABC, the authors suggested that support was found for the concurrent validity of the K-ABC with this population.

The purpose of this current study was to further explore the applicability of the K-ABC for assessing hearing impaired children.

A limited sample of 9 hearing impaired children ranging in age from 6 years 4 months to 11 years 10 months was administered the K-ABC. The results were analyzed in terms of subtest reliability and item characteristics. These results were then compared with the norming data.

Administration Procedures

During the evaluation of 7 of the 9 children tested, a sign language translator was present. The two exceptions were children whose verbal skills were sufficient to preclude the need for signing. Hearing losses for the 9 children ranged from moderate to profound.

The individual who served as the signing translator was the aide in the hearing impaired classroom. Her familiarity with the students tended to reduce their anxiety and assisted in establishing rapport between the examiner and the subjects. Additionally, her knowledge of the idiosyncrasies of each child's language offered support toward effective communication.

To maximize the effect of the translator, testing was done at a large table. The examiner and translator sat adjacent to each other with the child seated directly opposite them. This arragement allowed the child to lip read directions from the examiner and/or attend to signed directions. Additionally, the translator was able to clarify unclear responses for the examiner. In addition to standard verbal directions and signing, pantomime and gestures were used in instances where understanding was not apparent.

All subtests comprising the Mental Processing Composite were administered with the exception of Number Recall.

Results

A summary of mean Scale scores is provided in Table 1. Because Number Recall was not administered, a Sequential Scale score was obtained by employing the prorating procedure described in the scoring manual (Kaufman & Kaufman, 1983).

TABLE 1

Summary of Mean Scores and Range of Scores for Sequential Processing Scale, Simultaneous Processing Scale, Mental Processing Composite, and Nonverbal Scale

Scale	Mean Score	Range of Scores
SEQ	77.3	56 - 112
SIM	82.8	55 - 112
MPC	79.3	54 - 111
NV	80.9	54 - 111

Though these differences are not significant, the patterns appear to support previous research. This sample obtained its lowest mean score on the Sequential Scale. The highest mean score was obtained on the Simultaneous Scale. As noted by Courtney et al. (validity study 11), hearing impaired children tended to perform well on simultaneous tasks.

The somewhat higher mean score for this sample on the Simultaneous Scale as compared to the Nonverbal Scale may provide useful information as to subtest selection for this population. For school aged children both scales contain 5 subtests. Four subtests are common to both scales. The fifth subtest on the Simultaneous Scale is Gestalt Closure while the Nonverbal Scale is completed by the Handmovements subtest. This sample's relatively strong performance on the Gestalt Closure subtest, as discussed below, would appear to offer support for its inclusion when assessing this population.

Subtest Analysis

Results were analyzed in terms of subtest reliability for this hearing impaired sample. Computed alpha coefficients provided subtest reliability estimates ranging from .86 to .96. Table 2 provides a summary of subtest mean scaled scores and reliability estimates for both the norming population and the hearing impaired sample. Norm data was taken from the Interpretive Manual of the K-ABC (Kaufman & Kaufman, 1983).

TABLE 2

Summary of Subtest Mean Scaled Scores and Reliability Estimates for Norming Population and Hearing Impaired Sample

	Norming Population		Hearing Impaired Sample	
Subtest	Mean Scaled Score	Reliability	Mean Scaled Score	Reliability
Hand Movements	9.9	.76	7.2	.86
Gestalt Closure	10.0	.71	8.7	.93
Triangles	10.3	.84	6.3	.96
Word Order	9.9	.82	5.2	.91
Matrix Analogies	10.1	.85	8.8	.86
Spatial Memory	10.1	.80	6.7	.96
Photo Series	10.0	.82	6.3	.95

Tables 3 through 9 summarize item p-values and correlations for each subtest for both the norming population and the hearing impaired sample. Norm data cited was taken from Kamphaus and Reynolds (1987).

Insert tables 3, 4, 5, 6, 7, 8, and 9

Though these results must be interpreted within the context of the small sample size, some performance patterns were evidenced. Mean item p-values were higher for the norming population on

all subtests with the exception of Gestalt Closure. On this subtest, the child is presented with a series of incomplete inkblot drawings. The task requires the child to visualize the drawing in its entirety and to identify the object represented. Subject performance on this subtest offers support of previously noted strengths evidenced by hearing impaired children on simultaneous tasks.

Relative to the norming population, this sample performed most poorly on Triangles, Word Order, Spatial Memory and Photo Series. The Word Order subtest provides a measure of recall of verbally presented stimuli. Initially, the examiner orally presents increasingly longer series of common items and the child responds by pointing to silhouette pictures of the items in the order presented. On subsequent tasks an interference component is added as the child must name a series of colors before responding. The nature of this task would appear to mediate against its efficacy for use with hearing impaired children. The more complex processing involved for this population reduces the tasks effectiveness as a measure of simple rote recall.

On the Photo Series subtest, this sample performed most poorly in comparison with the norming population. This task requires the child to place a series of randomly arranged pictures into their correct temporal sequence. Evidenced difficulties offer substantiation of previously noted problems on tasks involving integration of sequential and simultaneous processing.

Results evidenced on Triangles, Spatial Memory and Matrix Analogies somewhat contradicted previous research. While overall performance on Triangles was generally poor, inconsistencies were noted on individual item difficulties. This task requires

the child to reproduce a picture of an abstract design using a series of identical triangles. The individual triangles are each colored yellow on one side and blue on the other. Item performance for this sample was somewhat inconsistent as results on more difficult items paralleled or exceeded sample performance on earlier, less difficult, items. This sample appeared to benefit from cues offered by color patterns on presented pictures.

In comparison with the norming population, performance for this sample on the Spatial Memory subtest generally evidenced considerably greater item difficulties. This task requires the child to identify the location of randomly arranged pictures on a page. With the exception of the two most difficult items, results were well below those obtained by the norming population. The relative success of this sample on the last two items would appear to suggest the role of the attention component on this task.

On the Matrix Analogies subtest, the child is required to select the picture or design which best completes a presented analogy. Performance by this sample on this subtest closely approximated that of the norming population. While these results may be attributable to characteristics of this samll sample, they appear to contradict previously noted difficulties for hearing impaired children on tasks of this nature.

The Hand Movements subtest requires the child to attend to and then precisely duplicate a series of taps made with the palm, fist and side of hand. While the nature of this task would appear to simulate, to a degree, the skills required for signed communication, this sample evidenced some inconsistencies in attention. On more difficult sequences, the subjects appeared to periodically

shift attention from the hand movements to the examiner's face. It is felt that this may have reflected an effort to gain information beyond the purely visual stimuli.

Discussion

The results of this study suggest support for the reliability of the Nonverbal Scale of the K-ABC for hearing impaired children. Analysis of subtest items further offers support for the validity of Nonverbal Scale subtests for this population. Additionally, it was found that the Gestalt Closure subtest of the Simultaneous Scale provided reliable and valid information for this sample.

Though the Nonverbal Scale is designed to permit pantomimed administration, it is suggested that a more efficacious method of administration would incorporate the use of a sign language translator. In this instance, a translator was employed who was familiar to the children and who worked with them on a daily basis. In so doing, not only could directions and responses be facilitated through signing, but also the idiosyncratic nature of each child's language could be accounted for. The availability of signing capability also permitted administration of the Gestalt Closure subtest. As noted above, this subtest provided useful information toward gaining a picture of each child's abilities.

Based on this study, it is suggested that administration of the K-ABC to hearing impaired children should routinely incorporate signing capability. Further, it is felt that the presence of an individual familiar with the child would significantly enhance the examiner's ability to obtain an accurate picture of the child's ability. It is further suggested that the subtests

routinely administered to hearing impaired children should be expanded to include the Gestalt Closure subtest in addition to the Nonverbal Scale.

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TABLE 3

P-Values and Alpha Coefficients for Hand Movements Subtest

	Norming Population		Hearing Impaired Sample	
Item	P-Value	r_{pb}	P-Value	r_{bi}
1	.944	.43	1.000	---
2	.973	.31	1.000	---
3	.933	.49	1.000	---
4	.847	.49	1.000	---
5	.852	.52	1.000	---
6	.712	.65	.778	.55
7	.506	.55	.444	.55
8	.531	.60	.333	.78
9	.519	.65	.444	.42
10	.481	.57	.333	.31
11	.499	.60	.222	.44
12	.438	.57	.333	.78
13	.447	.67	.333	.85
14	.328	.61	.222	.52
15	.317	.63	.111	.59
16	.235	.56	.111	.59
17	.208	.51	.222	.90
18	.152	.46	.111	.59
19	.094	.39	.000	---
20	.076	.39	.000	---
21	.046	.32	.111	.59

TABLE 4

P-Values and Alpha Coefficients for Gestalt Closure Subtest

	Norming Population		Hearing Impaired Sample	
Item	P-Value	r_{pb}	P-Value	r_{bi}
1	.982	.23	1.000	---
2	.953	.40	.889	.27
3	.834	.65	.778	.65
4	.799	.60	.889	.59
5	.742	.59	.889	.59
6	.836	.56	.778	.57
7	.763	.69	.556	.81
8	.791	.70	.667	.79
9	.737	.67	.778	.32
10	.749	.59	.889	.59
11	.691	.71	.556	.81
12	.667	.71	.556	.81
13	.661	.64	.556	.75
14	.564	.68	.444	.64
15	.554	.67	.556	.81
16	.534	.70	.444	.58
17	.530	.64	.556	.47
18	.520	.67	.444	.68
19	.279	.55	.444	.91
20	.229	.53	.333	.79
21	.122	.41	.333	.36
22	.081	.37	.111	.32
23	.076	.34	.333	---
24	.056	.31	.111	---
25	.033	.24	.111	---

TABLE 5

P-Values and Alpha Coefficients for Triangles Subtest

	Norming Population		Hearing Impaired Sample	
Item	P-Value	r_{pb}	P-Value	r_{bi}
1	.963	.36	.889	.42
2	.894	.59	.667	.64
3	.820	.69	.556	.76
4	.799	.78	.444	.95
5	.782	.79	.556	.79
6	.763	.81	.556	.79
7	.707	.81	.444	.95
8	.687	.80	.556	.79
9	.623	.80	.444	.95
10	.609	.80	.333	.91
11	.627	.83	.333	.91
12	.281	.57	.222	.70
13	.285	.64	.333	.91
14	.209	.57	.222	.75
15	.370	.71	.111	.43
16	.157	.51	.111	.56
17	.101	.44	.000	---
18	.033	.25	.111	.56

TABLE 6

P-Values and Alpha Coefficients for Word Order Subtest

	Norming Population		Hearing Impaired Sample	
Item	P-Value	r_{pb}	P-Value	r_{bi}
1	.976	.27	1.000	---
2	.920	.50	.778	.52
3	.926	.48	1.000	---
4	.914	.51	.889	.39
5	.854	.68	.556	.81
6	.816	.72	.778	.45
7	.780	.78	.444	.89
8	.621	.77	.111	.66
9	.625	.80	.444	.89
10	.604	.78	.111	.40
11	.618	.83	.333	.91
12	.327	.61	.111	.66
13	.280	.57	.000	---
14	.313	.59	.222	.73
15	.275	.57	.222	.80
16	.251	.55	.111	.40
17	.131	.42	.000	---
18	.167	.47	.222	.73
19	.107	.39	.111	.66
20	.029	.23	.000	---

TABLE 7

P-Values and Alpha Coefficients for Matrix Analogies Subtest

	Norming Population		Hearing Impaired Sample	
Item	P-Value	r_{pb}	P-Value	r_{bi}
1	.943	.36	.889	.35
2	.938	.38	.667	.52
3	.926	.38	.889	.35
4	.915	.38	1.000	---
5	.659	.51	.889	.35
6	.770	.59	.889	.17
7	.736	.55	.556	.26
8	.703	.52	.778	.33
9	.711	.58	.778	.46
10	.543	.60	.556	.55
11	.434	.53	.444	.37
12	.493	.66	.222	.91
13	.350	.57	.222	.91
14	.357	.71	.222	.91
15	.392	.69	.222	.91
16	.259	.61	.444	.77
17	.196	.58	.111	.74
18	.183	.61	.111	.74
19	.176	.52	.000	---
20	.153	.58	.000	---

TABLE 8

P-Values and Alpha Coefficients for Spatial Memory Subtest

	Norming Population		Hearing Impaired Sample	
Item	P-Value	r_{pb}	P-Value	r_{bi}
1	.974	.31	.667	.88
2	.985	.25	.778	.72
3	.947	.39	.778	.72
4	.957	.38	.667	.88
5	.928	.47	.556	.79
6	.889	.56	.667	.88
7	.885	.48	.556	.79
8	.743	.61	.444	.81
9	.770	.65	.556	.86
10	.631	.66	.444	.81
11	.819	.68	.667	.88
12	.699	.71	.444	.81
13	.647	.71	.444	.81
14	.508	.63	.111	.51
15	.241	.57	.111	.51
16	.154	.50	.111	.46
17	.239	.57	.222	.73
18	.151	.53	.111	.51
19	.159	.55	.000	---
20	.109	.45	.222	.73
21	.096	.44	.111	.46

TABLE 9

P-Values and Alpha Coefficients for Photo Series Subtest

	Norming Population		Hearing Impaired Sample	
Item	P-Value	r_{pb}	P-Value	r_{bi}
1	.962	.33	.778	.62
2	.939	.40	.556	.94
3	.897	.53	.556	.94
4	.892	.54	.556	.94
5	.888	.56	.444	.92
6	.740	.52	.556	.94
7	.847	.54	.556	.94
8	.799	.59	.333	.77
9	.768	.59	.444	.92
10	.532	.63	.333	.77
11	.420	.70	.222	.63
12	.280	.63	.111	.53
13	.239	.54	.111	.31
14	.304	.69	.111	.53
15	.239	.62	.000	---
16	.226	.62	.000	---
17	.209	.59	.000	---